CLAIMS

1. A contact element for making an electric contact to a contact member (5, 15, 19, 41) for enabling an electric current to flow between said contact element and said contact member, said contact element (3,14, 20, 32, 42) comprising a body (6) having at least a contact surface (2, 4, 16, 21, 22, 24, 30, 34, 43, 44) thereof coated with a contact layer arranged to be applied against said contact member, which contact layer comprises a film comprising a multielement material, **characterised in** that said multielement material has equal composition as at least one of a carbide or nitride that is described as $M_{n+1}AX_n$ where M is a transition metal or a combination of a transition metals, n is 1, 2, 3 or higher, A is a group A element or a combination of a group A element, and X is Carbon, Nitrogen or both, said multielement material also comprise at least one nanocomposite comprising single elements, binary phases, ternary phases, quaternary phases or higher order phases based on the atomic elements in the corresponding $M_{n+1}AX_n$ compound.

2. A contact element according to claim 1, **characterised in** that said nanocomposite comprise at least two of the following phases: M-A, A-X, M-A-X, X, M-X, or a combination of said materials.

3. A contact element according to any of claim 1 or 2, **characterised in** that said nanocomposite comprise at least one of the following of M-X and M-A-X nanocrystals (C, D, E) and at least one of the following amorphous regions (J, K, L) with M, A, X elements in one or several phases, such as M-A, A-X, M-A-X, or X.

4. A contact element according to any of the preceding claims, **characterised in** that said transition metal is Titan; Ti, n is 1, 2, 3 or higher, X is C; Carbon and A is at least one of Silicon; Si, Germanium; Ge or Tin; Sn or a combination of said atomic elements.

5. A contact element according to any of claims 1-3, **characterised in** that that said multielement material is Ti_3SiC_2 and the nanocomposite comprise at least one of the following Ti-C, Si-C, Ti-Si-C, Ti-Si, C or a combination of said materials.

6. A contact element according to any of claims 1, 2, 4 or 5, **characterised in** that said nanocomposite of the multielement material of said film is at least partially in an amorphous state.

7. A contact element according to any of claims 1, 2, 4 or 5, **characterised in** that the multielement material of said film is essentially in an amorphous state comprising one or several regions of M-A-X, A-X,M-A, M-X, X, A, M elements.

8. A contact element according to any of claims 1, 2, 4 or 5, **characterised in** that said nanocomposite of the multielement material of said film is at least partially in a nanocrystalline state.

9. A contact element according to any of preceding claims, **characterised in** that said nanocomposite of the multielement material of said film has amorphous regions mixed with regions in a nanocrystalline state.

10. A contact element according to any of the preceding claims, **characterised in** that said film comprise individual regions (C, D, E) that is single element, binary phases, ternary phases and/or higher order phases of carbide and nitride.

11. A contact element according to any of the preceding claims, **characterised in** that said multielement material comprise individual

regions (C, D, E) that is a single element, binary phases, ternary phases and/or higher order phases with an average composition equal to or similar carbide and nitride.

12. A contact element according to any of the preceding claims, **characterised in** that said film comprise a nanocomposite which composition correspond to a combination of different $M_{n+1}AX_n$ phases.

13. A contact element according to any of the preceding claims, **characterised in** that the thickness of said film is in the range of a fraction of an atomic layer to 1000 µm

14. A contact element according to any of the preceding claims, **characterised in** that the thickness of said film is in the range of 0.0001 µm to 1000 µm.

15. A contact element according to any of the preceding claims, **characterised in** that the thickness of said film is in the range of a fraction of an atomic layer to 5 µm.

16. A contact element according to any of the preceding claims, **characterised in** that said film comprise a metallic layer (Me), the thickness of the metallic layer is in the range of a fraction of an atomic layer to 1000 µm.

17. A contact element according to claim 16, **characterised in** that the thickness of the metallic layer in the range of a fraction of an atomic layer to 5 µm.

18. A contact element according to any of the claims 16-17, **characterised in** that the thickness of the metallic layer in the range 1 nm to 1000 µm.

19. A contact element according to any of the claims 16-18, **characterised in** that said metallic layer is any of Au, Ag, Pd, Pt, Rh or an alloy with at least one of any of the afore mentioned metals.

20. A contact element according to any of the claims 16-19, **characterised in** that said metallic layer is any metal or a metal alloy.

21. A contact element according to any of the claims 16-20, **characterised in** that said metallic layer is any metal or metal composite where the composite can be an oxide, carbide, nitride or boride.

22. A contact element according to any of the claims 16-21, **characterised in** that said metallic layer is any metal or metal composite, said composite comprising a polymer, an organic material or a ceramic material such as an oxide, carbide, nitride or boride.

23. A contact element according to any of the claims 16-22, **characterised in** that said multielement material layer is laminated with metallic layers (Me) in a multilayer structure.

24. A contact element according to any of the claims 16-23, **characterised in** that said multielement material has a coat of said metallic layer (Me), in that the contact surface is metallic (Me).

25. A contact element according to any of the claims 16-24, **characterised in** that the metallic layer covers grains or regions of the

multielement material, with the total film thickness is in the range 0.0001 µm to 1000 µm.

26. A contact element according to any of the claims 16-25, **characterised in** that the metallic layer is sufficiently thick to be able to wire-bond or solder a surface in a bonding to establish a non-separable electrical bond at the surface.

27. A contact element according to any of the preceding claims, **characterised in** that said film is continuous.

28. A contact element according to any of the claims 13-27, **characterised in** that said film is discontinuous.

29. A contact element according to any of the preceding claims, **characterised in** that said film is deposited on said body and adheres thereto.

30. A contact element according to any of the claims 1-29, **characterised in** that said film is arranged as freestanding foil to be applied against said contact member when making said electric contact.

31. A contact element according to any of the claims 1-30, **characterised in** that said film is doped by one or several compounds or elements for altering and improving friction, mechanical, thermal and electrical properties of said film.

32. A contact element according to any of the preceding claims, **characterised in** that said film comprise at least one single element M, A, X in the corresponding $M_{n+1}AX_n$ compound within a range of 0-50% by weight.

33. A contact element according to claim 29, 31 or 32, **characterised in** that said film is formed on said body by means of a chemical method such as an electroless or an electrolytic process.

34. A contact element according to claim 29, 31 or 32, **characterised in** that said film is deposited on said body by the use of a vapour deposition technique.

35. A contact element according to claim 34, **characterised in** that said film is deposited on said body by Physical Vapour Deposition (PVD) or Chemical Vapour Deposition (CVD).

36. A contact element according to claim 29, 31 or 32, **characterised in** that said film is deposited on said body by dipping the body in a chemical solution or spraying it on said body through for example thermal or plasma spraying.

37. A contact element according to claim 29, **characterised in** that said film is deposited using a combination of the techniques according to claims 30-36.

38. A sliding electric contact arrangement, i.e. a contact arrangement in which a first contact surface (2, 4, 16, 21, 22, 24, 30, 34, 43, 44) on a contact element and a second contact surface (2, 4, 16, 21, 22, 24, 30, 34, 43, 44)on a contact member adapted to be applied against each other for establishing an electric contact may slide with respect to each other when establishing and/or interrupting and/or maintaining the contact action, **characterised in** that the contact element (3,14, 20, 32, 42) coated with a film comprising a multielement material according to any of the preceding claims is arranged to form

a dry contact with a friction coefficient, below 0.6, preferably below 0.2, to the contact surface on the contact member (5, 15, 19, 41).

39. A contact arrangement according to claim 38, **characterised in** that also said contact surface (2, 4, 16, 21, 22, 24, 30, 34, 43, 44) on the contact member (5, 15, 19, 41) is coated with a film comprising a multielement material.

40. A contact arrangement according to any of claims 38-39, **characterised in** that said surfaces of the contact element (15) and the contact member (14) are allowed to move with respect to each other as a consequence of magnetostriction or different coefficients of thermal expansion of the materials of surface portions of the contact element and the contact member upon temperature changes of the contact element and the contact member.

41. A contact arrangement according to claim 40, **characterised in** that the contact element (15) and the contact member (14) are adapted to be pressed towards each other for establishing said contact.

42. A contact arrangement according to claim 41, **characterised in** that the contact element (15) and the contact member (14) are adapted to be forced against each other by bolts or screws for establishing said electric contact there between.

43. A contact arrangement according to any of claims 38-42, **characterised in** that one (5, 41) of the contact element and the contact member is male-like and the other (3, 42) is female-like, and that the contact element and the contact member are adapted to establish said electric contact by being brought into engagement with each other.

44. A contact arrangement according to any of claims 38-42, **characterised in** that it comprises means for spring-loading the contact element and the contact member against each other for making said electric contact

45. A contact arrangement according to any of claims 38-42, **characterised in** that one of the contact element and the contact member belong to two parts of a mechanical disconnector movable away from each other for disconnecting two terminals thereof.

46. A contact arrangement according to any of claims 38-42, **characterised in** that one of the contact element and the contact member belong to two parts of a mechanical breaker movable away from each other for breaking the current path between the terminals thereof.

47. A contact arrangement according to any of claims 38-42, **characterised in** that one of the contact element and the contact member belong to a crimp contact.

48. A contact arrangement according to any of claims 38-42, **characterised in** that the contact element (20) and the contact member are adapted to establish an electric contact in an electric rotating machine (18).

49. A contact arrangement according to claim 48, **characterised in** that the contact element and the contact member are adapted to establish an electric contact between two parts (19,29) of the machine moving with respect to each other when the machine (18) is in operation with the contact element and the contact member arranged on a separate such part.

50. A contact arrangement according to claim 48, **characterised in** that said moving part is a slip ring (19).

51. A contact arrangement according to any of claims 38-42, **characterised in** that it is adapted to establish an electric contact in a tap changer(28) for a transformer for making a contact to different winding(29) turns of the transformer.

52. A contact arrangement according to any of claims 38-42, **characterised in** that one of the contact element (32) and the contact member (33) belong to the parts movable with respect to each other in a relay for establishing an electric contact there between when the relay operates.

53. A method for creating a thin layer on a contact member for making a good electric contact of said contact member to a contact member for connection to said contact member and having a low friction coefficient with respect to said contact members pressed together for forming said good electric contact, **characterised in** that that the multielement material is coated with the metallic layer.

54. A method for creating a thin layer on a contact member for making a good electric contact of said contact member to a contact member for connection to said contact member and having a low friction coefficient with respect to said contact members pressed together for forming said good electric contact, **characterised in** that the multielement material is blended in the metallic layer.

55. Use of a contact arrangement according to any of claims 38-42, in which a contact for enabling contact to an electronic device, such as an integrated circuit (IC) is covered with a said multielement material film enabling electrical contact to the device.

56. Use of a contact arrangement according to any of claims 38-42, in which a probe for measuring and testing an integrated circuit (IC) is covered with a said multielement material film avoiding chemical degradation and metal cladding on the probe.